

# An electron microscope look at wing scales in “greasy” Lepidoptera

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**Summary.** The ultrastructural consequences of “wing grease” in dried Lepidoptera specimens are examined and described for two cases (Agathiphagidae: *Agathiphaga vitiensis* Dumbleton, 1952 and Hepialidae: *Hepialus humuli*). The ultrastructure of the wing scales and of the wing surface are heavily obscured.

**Zusammenfassung:** Die Auswirkungen “verölter” Flügel auf die Feinstruktur von Schmetterlingsflügeln werden an zwei Beispielen beschrieben und illustriert (Agathiphagidae: *Agathiphaga vitiensis* Dumbleton, 1952 und Hepialidae: *Hepialus humuli*). Die Ultrastruktur der Flügelschuppen wird durch Verölung weitgehend verdeckt.

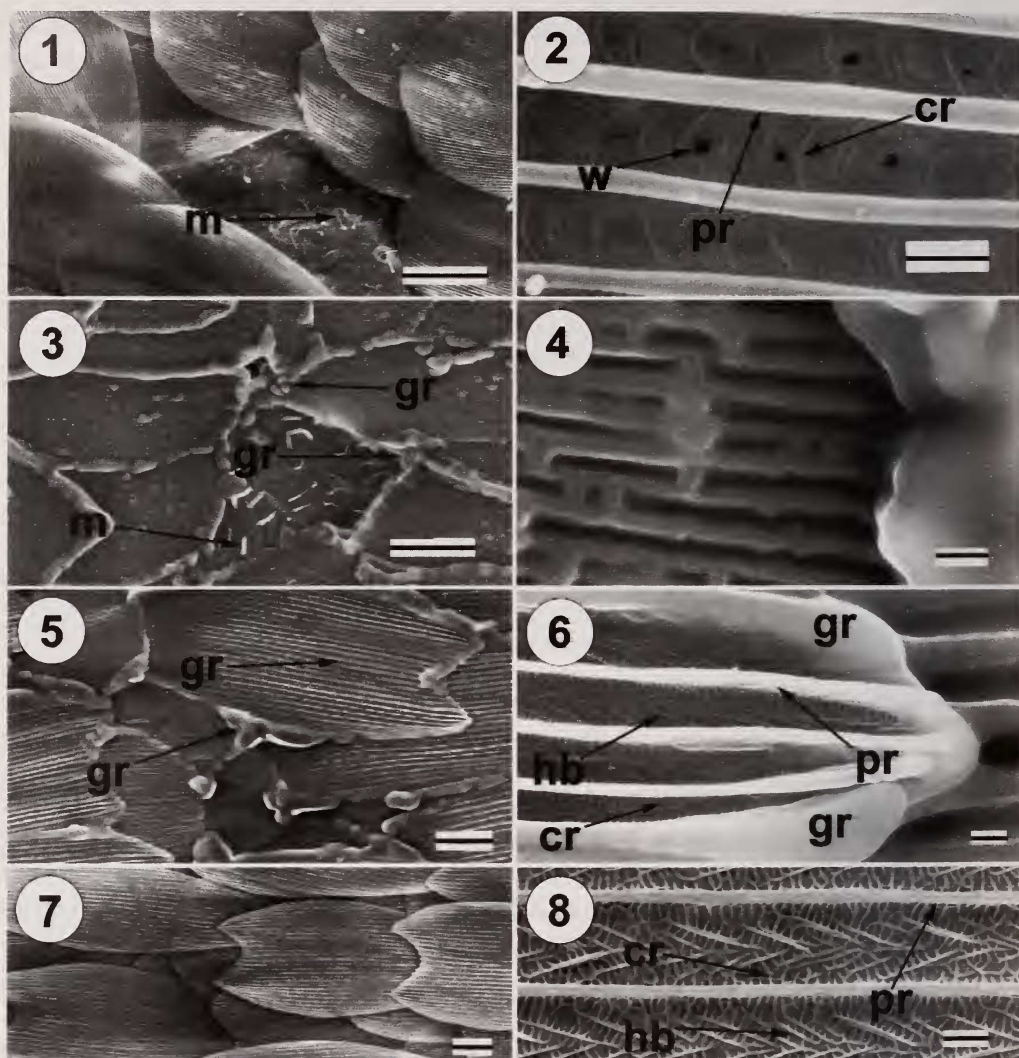
**Résumé.** Les conséquences ultrastructurelles du „graissage des ailes“ de spécimens de lépidoptères desséchés sont examinées et décrites pour deux cas (Agathiphagidae: *Agathiphaga vitiensis* Dumbleton, 1952 et Hepialidae: *Hepialus humuli* (Linné, 1758)). L’ultrastructure des écailles alaires et de la surface alaire sont fortement obscurcis.

**Key words:** Lepidoptera, wing scales, specimens, collections.

Greasiness in dried Lepidoptera is well known among lepidopterists as a very irritating phenomenon which can literally ruin collection specimens. It is due to fats exuding from the animals fat body, and it is most common in taxa with boring larvae (Wolff 1934). Not only does the phenomenon alter the overall appearance of the wing colours and patterns, hence making the specimen useless for macroscopical pattern/colour diversity studies; the phenomenon also obscures the fine details of the wing surface and of the wing scales. However, little attention has been given to the ultrastructural consequences of the grease. This note unveils some of these consequences as seen with the scanning electron microscope, and reports on the effects of cleaning the wings with organic solvents.

Dorsal forewing sectors from one greasy and one clean specimen of male *Hepialus humuli* (Linnaeus, 1758) and one greasy specimen of *Agathiphaga vitiensis* Dumbleton, 1952 were examined in a JEOL JSM-840 scanning electron microscope (SEM). Another forewing sector of the same *A. vitiensis* specimen was first cleaned in absolute ethanol (18 hours), subsequently in benzol (12 hours) and finally freeze dried before it was examined with SEM. The cleaned *A. vitiensis* wing sector was freeze dried to make sure that all benzol was removed from it before coating it with gold in a sputter coater (standard SEM preparation procedure). This may not be necessary when using some newer sputter coaters, but since especially some older models require totally dry material, I choose this extra step in the procedure.

The results demonstrate a remarkable difference between the greasy and the cleaned *H. humuli*. In the clean specimen (Figs. 1-2) sculptures such as longitudinal ridges, windows



**Figs. 1–8.** 1–4: *Hepialus humuli*. 1 – Clean wing scales and wing surface with microtrichia (m); 2 – Detail of 1 with windows (w), primary ridges (pr) and cross ribs (cr); 3 – Greasy (gr) wing scales and wing surface; 4 – Detail of 3. 5–8: *Agathipha vitiensis*. 5 – Greasy wing scales, note that some pr, cr and herring bone crests (hb) are visible; 6 – Detail of 5. 7 Cleaned wing scales; 8 – Detail of 7. (Reference bars: 1, 3, 5, 7 = 20 μm. 2, 6, 8 = 1 μm. 4 = 2 μm).

and cross ribs on the scales and microtrichia (Downy & Allyn 1975, Ghiradella 1998) on the wing surface are clearly visible. In the greasy specimen (Figs. 3–4), however, almost no scale ultrastructure is visible and even the microtrichia are largely obscured. The *A. vitiensis* specimen illustrated in Figs. 5–6 is not as heavily greased as the *H. humuli* specimen; on parts of the wing scale surface sculptures such as longitudinal ridges and herring bone crests (Kristensen 1970; Common 1973; Simonsen & Kristensen *in prep.*) are visible. After cleaning as described all the wing scale sculptures are visible again (Figs. 7–8).

In both examples the most conspicuous greasing effect is a deposition of fat along the scale margins. Such fat deposits are likely to occur at a rather early stage of greasiness development in preserved specimens, and their presence indicate that cleaning (e.g. as described) is mandatory before reliable ultrastructural observations can be made. It must be emphasised that moderate greasiness is *not* always obvious from low-magnification observation of Lepidoptera specimens.

### References

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## Book Review

Holloway, J. D., G. Kibby & D. Pegg 2001. **The families of Malesian moths and butterflies.** Fauna Malesiana Handbooks 3, xi + 455 pp, 8 colour pls.: 8–174, 125 textfigs. – Brill Academic Publishers, Leiden. – ISBN: 90-04-11846-2. Price: € 118.00.

Though principally addressing Lepidoptera of the Oriental region, this new volume is also of great interest to readers concerned with other biogeographical realms. It is divided into four main sections. The introduction provides profound information about phylogeny, higher classification, biogeography and biology, but also informs about technical aspects of collecting, genitalia preparations, and important literature and reference collections relevant to the focal region, Malesia (i.e. SE Asia and Newguinea). The second section deals with external, and to a lesser degree internal, morphology of Lepidoptera, including early stages. In the third chapter a key to all major families is provided, supplemented with highly informative 'quick fixes' for sorting (tropical) Lepidoptera and their larvae to family level. Also some very thoughtful summary accounts of hostplant relationships are given. The fourth, and main, chapter (180 pp.) consists of brief accounts of all family level taxa (including those not occurring in Malesia) with many hints to diagnostic features as well as biological or biogeographical peculiarities. A selection of fine colour plates (by B. D'Abrera) gives a first glance of the family diversity of Malesian Lepidoptera. Appendices on species richness patterns, pest Lepidoptera, a very extensive and splendidly up-to-date list of references (close to 1000 entries), and indexes to morphological terms and names complete this volume.

This new book gives a succinct introduction into most aspects of the study of Lepidoptera and therefore will be of particular interest to those who are not (yet) experts on this insect order. In many respects it may replace the two treatments authored by I. F. B. Common (*Moths of Australia*, Brill, 1990) and M. J. Scoble (*The Lepidoptera*, Oxford University Press, 1992). In particular, due to its relatively moderate price it will be attractive for those just starting with the study of Lepidoptera or with a smaller budget. Treatments of systematics, biogeography, or diversity issues are of current-edge status. Though much of the information presented is also available elsewhere, this handy and most readable compilation, spiced with numerous new details from the first author's unrivalled field experience with Oriental Lepidoptera, makes this volume a most valuable addition to the book market. If I were asked by a student or colleague which book to choose to become acquainted with Lepidopteran diversity without going lost in detailed handbook length monographs, I would confidently recommend: take that new Holloway et al. volume.

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